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An Essay

On the Identity of Electricity
and Nervous Influence

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of Annapolis Md

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On the Identity of Electricity and the Nervous Influence.

No part of the anatomy and physiology of man is more important, than the nervous system. It is this system which forms the great characteristic between the vegetable and animal kingdoms. It is its greater development, which renders one animal superior to another; and, and it is its perfection which renders man superior to the brute creations.

It is not my intention, in this Thesis, to describe the anatomical structure of the brain, the great organ of intellect, nor, of the nerves, which are the means of communication between the brain and other organs of the body, but, to offer such facts and arguments, as I have been able to collect, to prove the Identity of electricity and the nervous influence.

Let us inquire what is this agent, the nervous influence or fluid, which forms

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the connecting link between mind & matter,
between the mere material machine and
the immaterial and immortal principle
of man. Is it a solid, is it a fluid, or is it
an invisible fluid; as magnetism, heat, electricity,
or galvanism?

We know, that it is through the
the nerves that an impression, made on one of
the senses the sense of touch, is conveyed to the
centre of perception, and makes an impression,
called a sensation; because if this nervous fibre
is destroyed, no impression can be conveyed.

We further know, that the power, by which the
will acts through the centre of perception, on
certain muscles, for the performance of certain
motions or functions, is conveyed by nervous
filaments, because, that power may be destroy-
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this nervous connexion.

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But in neither case, do we know the exact medium of this communication.

It has been asserted by some, that a nerve is an assemblage of small ^{tense} cords, cords, assimilated by their tension to solid bodies, and that ^{an} impression, made ^{at} on one end, conveys a sensation to the ^{other}, as in the case of a string of a musical instrument.

Now, this simple fact, that the nerves are non-elastic, and must necessarily be relaxed during flexions of the limbs, at once disproves this mechanical explanation.

Others assert, that the nervous fibre is a tube, filled with a gelatinous or fluid matter, which is a good conductor of impressions or impulses; and, that sensations are conveyed through this fluid, as in the labyrinth of the ear. It may be objected to this explanation, that it is by no means a

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determined fact in physiology, that the nerves
are tubulated, much less has it been proved
that they contain this gelatinous matter. Magendie
says, he has repeatedly tried to ascertain whether the
nervous fibres were tubes, but could never satisfy
himself of the fact. However, this explanation is
at once done away, by the recent experiments of
Sir Rb Philip and others, which clearly ^{the fact} established
that impressions may be conveyed, though the
nerve be divided, provided, the ends of the
nerve be not too far separated.

Others believe, that the medium of
this communication is a peculiar invisible
fluid ^{analogous} to electricity or galvanism.
Experiments recently made, have tended much
to such a belief.

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the functions of the lungs and stomach, but, until recently, the exact effect of this section had not even discovered.

By the experiments of Les-^{le} M. Bricot, in London, and Dr. Brechet, in Paris, the following facts have been elicited.

1.st That, if a part of a nerve is cut, still the two ends of the divided nerve separating, the process of digestion is entirely suspended.

2.nd That the process of digestion, having been thus suspended, may be again established, to a certain extent, by bringing the two ends of the divided nerve into contact or, by introducing between them a conductor of electricity.

3.rd That the process of digestion, having been suspended as in the first operation, may be again established, by



on attaching, to the lower end of the divided nerve, the positive pole of a galvanic battery, the negative end being in connexion with the lower end of the stomach, ^{the substituting} the galvanic for the nervous influence.

The following experiments were tried on horses by Breschet, after having been performed successfully on smaller animals.

Four horses were selected, and all fasted for some time after a long abstinence. In one, the nerves of the stomach were divided, and ^{separately,} ~~the~~ ends, ~~the~~ second were left untouched.

The third submitted to the following treatment: the nerves of the stomach were divided, and their ends separated, as in the first horse, the inner ends of the nerves were then connected with the positive pole of a galvanic battery, the negative pole being connected with the lower end of the stomach.



... were the unequivocal results:
in the horse, that had been left untouched
with all the food was digested and disposed
from the stomach to the intestines.
In the horse whose nerves had been divided
but connected with several galvanic arcs,
the food was almost in the same state,
as in the horse that had been untouched.

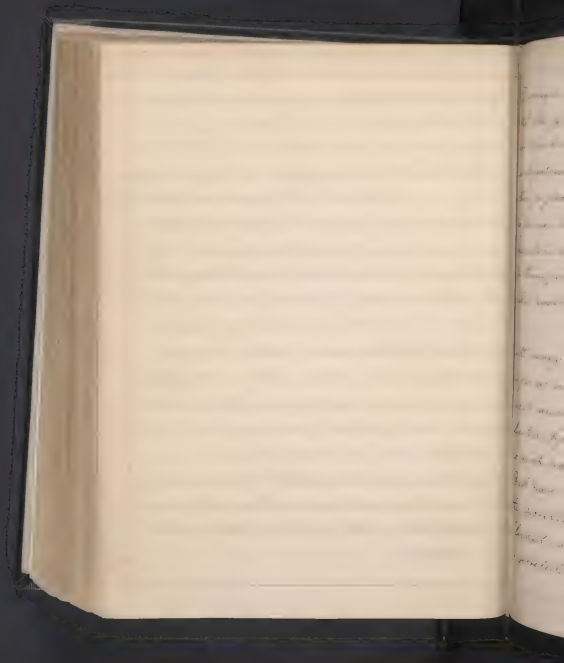
On the other hand; in the
horse, whose nerves had been divided &
had not been galvanised, little or no digestion
had taken place, three times as much
undigested food having been found in
his stomach, as in the stomachs of the
other two horses.

Dr Breschet objects to this
theory, and endeavours to prove, that, when
induced by galvanism after the section
of the pneumo-gastric nerve, it is not by



chemical change, but in exciting the coat
of the stomach; and, he has endeavoured to
prove, in experiment, that mechanical irri-
tation has the same effect in a *lepis alpestris*.

But, to this opinion of Boerhaave,
we may readily oppose the result of Dr. Keil's
experiments who, says he has repeated the
experiment of mechanical irritation, after
the section of the ^{nerve} alluded to, and that
the food exhibited no more appearance
of digestion than when there was no
mechanical irritation; though the experiment
was continued, for eight hours, the time the
animal lived after the operation. Dr. Keil
sheds this with confidence, because he is
perfectly acquainted with the appearance of
the rabbit's stomachs under those experiments,
a rabbit being the animal operated on
by Boerhaave.



These experiments, therefore, if they do not prove
that the galvanic force and nervous influence
are identical, at least prove conclusively that
in digestion, the one may be substituted for the
other, a fact that had been long established
in the case of separate muscular actions, by galvanizing
excited crickets, and thereby, inducing
in them, violent and long continued mus-
cular contractions.

The great difficulty has been
with many, to comprehend how a fluid, which
as far as we can judge, is produced by mechan-
ical and chemical means alone, can be
directed by the liver, an organ in which
no such actions can take place.

But have we not analogous instances, in
the secretion of the fluid ^{heat} in all warm
blooded animals, and in light which
is secreted by the Fireworm, & Firefly?



and yet, these facts are not doubted, although we cannot explain their phenomena.

However, so as to prevent our being left in doubt, as to the power of the brain to excite the electric fluid, nature has furnished us with unconscionable instances of it in the Torpedo, and other electrocal animals. It is well known, that the Raie Torpedo, the *Amphiprion*, *Electrophorus*, *Scinus Electricus*, have a power of giving out, at pleasure, violent electrical shocks; so much so, as to benumb, or destroy, smaller animals, and even man, when partly exposed to their influence. Now, for a long time, doubted whether this was purely an electrical phenomenon; but the fact is now established, beyond the possibility of doubt. By experiments, it has been proved, that these animals give out, at pleasure, massive shocks of electricity, and that this electricity differs, in no wise, from that emitted from an electrocal mass.



but when it is established, the animal can
in a long time conceal it, and, therefore,
when, and the electricity is sufficient to be
produced in motion produced by muscular action.
It has been shown, by experiment, that the
muscle is entirely insensible, no muscular
action having been found, which is sufficient
the necessary friction, and the machine which
is the power of circulating it by friction.

But it has been proved, that the animal
in the power, when completely isolated, is
sufficient to give the electrical fluid, as
long as vitality exists, a power which is
not a mechanical machine, for, in all cases,
when electrical is elicited by friction the
negative wire of the apparatus must be
in connection with the earth, or some other
great electrical reservoir. It has been further
discovered, that the animal has not the



over a revolving turn, thus, it is clear, even, but
collected, in some cases, into, simply, in
part, in connection with the surrounding
fluid, or its external entanglements.

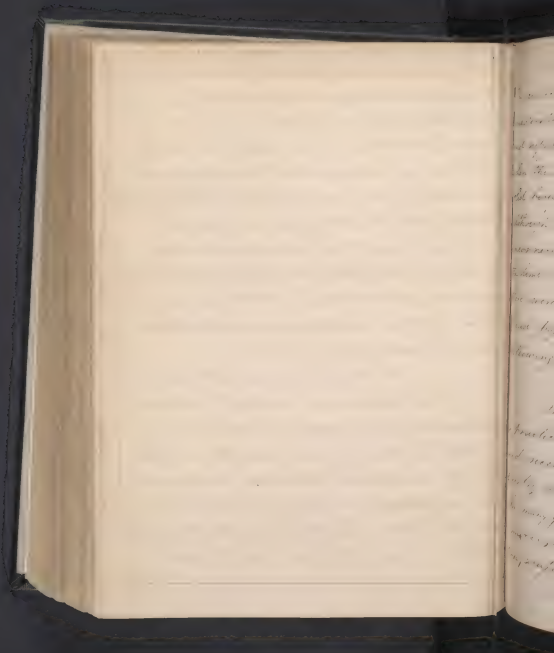
The immediate source of the fluid was, still
doubtful, when its character, nearly established,
in dissection, that it was derived from the
arteries and blood of the animal; the animal,
and the electrical apparatus of the animal
inserted, a number of angular columns
in a rectangular substance, filled with a
substance, completely isolated
in cellular membrane, from the surrounding
fluid of the animal, and receiving large nerves
from the brain. This is the electrical organ,
which receives the fluid secreted by the
brain, through the large nervous communication
connection with that organ.



the apparatus, having but little reaction or motion,
could have required but small nerve for its
support, if it had not been for the great
power of the nature, which thus enables the
animal to lay up a supply of electricity for its
defence, and the destruction is seen.

Thus we have clearly established these
important facts, that animals have the power
of storing electricity, that the brain is the
organ of this secretion, and that the nerves
are its conductors.

In the 8th volume of the collected
Physiognomic Review, we have the following
fact and observations, which tend much to
establish the identity of electricity and the
nervous influence. Dr Edwards has observed,
that electricity is necessary to muscular
contraction, in the following simple experi-
ments.



The sciatic nerve, if it is ~~dis~~ separated, a considerable distance from the surrounding parts, and supported by a non-conductor of electricity, when this separated part was rubbed, by any solid body, muscular contractions took place, although the limb was at the same time unconnected with the sensorium. But when the limb was supported by a conductor of electricity, there were no contractions in the limb, the hand passing of to the conductor, instead of following the course of the nerve.

The phenomena of acupuncture, a practice first adopted by the Chinese, and recently introduced into Europe and this country has thrown some light on this subject. In many diseased nerves, especially Rheumatism, and in many cases of local inflammation, acupuncture has given almost immediate relief.

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in explanation of this phenomenon has been
suggested. Some, have attributed the
relief to the counter irritation, and others
the imagination of the patient's imagination
controls, but both of these explanations are
unsatisfactory. The very slight irritation,
being produced by the operation, is a convincing
proof, that the relief obtained is not to be
attributed to counter irritation. men have been
examined, on some of the same cases, but
a slight benefit. This fact in itself
shows is not dependent on the influence
the imagination has been proved by
experiment.

It has been recently discovered
that, in all cases where relief was obtained
the needles exhibited strong marks of the
salvage influence, and, the probability
that the relief is obtained by the means

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strong, as an electrical conductor to the super-
fuous animal electricity, an accumulation
of which, in the part affected, constitutes
the disease. Some of the French Surgeons
have recently proved this, beyond the
possibility of a doubt, by the use of
sensitive Electrometers, which clearly
indicated the escape of the fluid in
such cases.

From all these facts, I think we are
justified in concluding, that the nervous
and electrical fluids are identical and,
that electricity is the fluid which nature
employs to occupy this important station
in the human system. And surely a
more suitable agent could not well
be imagined; the rapidity, with which
it passes through its conductors, is such

[illegible]

that no perceptible time is occupied, in conveying by it, impressions from the extremities to the centre of perception. Isolated by such a medium, it can only flow through those channels provided for its passage.

Occupying, as it does, so large a space in the great storehouse of nature; elicited & acting in all her operations, from the evaporation or condensation of a drop of water to the explosion of a thunder cloud, this invisible and almost incomprehensible fluid, we must admit, a worthy instrument with which the mind of man may be connected with its proper materials.

Now, it may be asked, can a fluid, which conveys but one impression produce all the modified actions of motion, sensation, and thought.



As Charles Bell has already established the
fact, that different nervous fibres are employed
in the conveyance of impressions, and the
induction of motions, and, it is probable
that a differing difference in the organisation
of the instruments is sufficient to produce
its their different modifications.

For example; light produces one impression
in the Retina, and another on the Ear, and
none on the surface of the body; whilst
heat induces an impression on the surface
of the body, and none on the Ear, or Retina;
and yet, it is more than probable, that
the nerves, which convey these impressions,
are of the same organisation, and that
the modifications of their impressions are
the result of a different organisation in
the part receiving the impression.



Thus then we may consider, the brain and spinal marrow as the secreting organs, as the noble agent of the mind, which, seated at the centre of perception, conveys to, and receives from, the different parts of the system, the sensations, impressions, and motions, which constitute the functions of the organic and animal lives.

All the intellectual operations, sentiments, and passions, and indeed every action connected with motions, sensation, or thought, are performed through, the agency of this secreted fluids. Every sensation, motion, and mental operation being performed by an expenditure of the nervous influence, a constant supply must be furnished by the brain and spinal marrow,



and conducted by the nerves to the different parts of the system. These nerves are good conductors, and are isolated, in their course, by cellular substance.

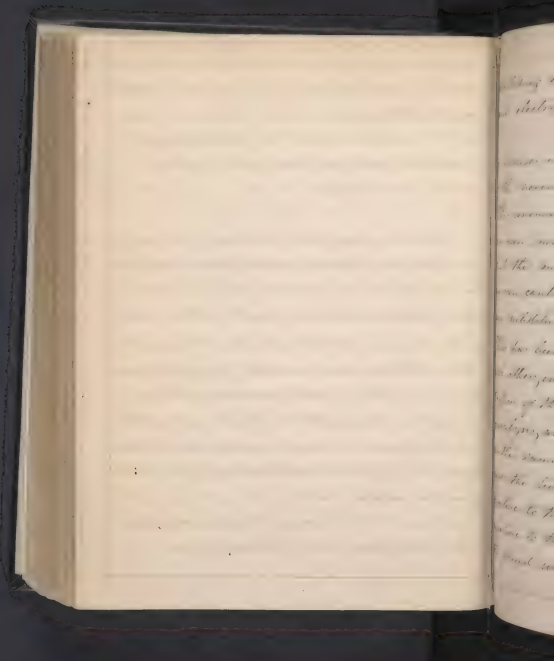
In man, there is an unequal distribution of this fluid to all the organs; and an unequal distribution is, in many cases, the cause of disease. If ~~too~~ large a proportion of it is expended, in the exertions of the mind, the muscular system languishes, and the digestive organs are deranged for want of their necessary stimulus. For this reason, we find, that men of intense application are liable to all those diseases of the muscular and digestive systems which are independent on a deficiency of the nervous fluid, as Languor, dyspepsia,



perfect secretion of bile, and torpor of the bowels. And, in such cases, abstinence from mental exertion, and an increase of muscular exercise, will alone afford permanent relief.

From Magendie's Journal of Physiology, we have the following extract, which proves that an Electro Magnetic influence is derived from Acupuncture. Mr Pouillet, after making a complete circuit through a needle, and through the patient's mouth, found by means of a multiplier of Schweigger with a magnetic needle, that the Electro Magnetic relation could be readily produced at least, as far as to affect small vibrations backwards and forwards.

It may be enquired, what the advantage to be derived from



establishing the identity of the nervous influence and electricity?

As before stated, a large class of diseases is dependant upon a deficiency of the nervous influence or animal electricity. This animal electricity, which is secreted; we can neither controul nor command; but the mechanical which is identical; we can controul and command, and we can substitute the one for the other.

This has been done by Sir W. Philip, M. C. B., and others, in cases (in cases) of dyspepsia, torpor of the secreting viscera, asthma, paralysis, and other diseases dependant on the same causes. In some of these cases, the two poles were thus applied: the positive to the back of the neck, and the negative to the region of the stomach, and the fluid was thus passed through the

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affected part. Sir. Wm. Brewster & Lussana, have lately made the needle the medium for introducing galvanism, by first applying the needles, as in acupuncture, and applying the positive pole to one needle, and the negative to the other. They considered this the most effectual way of applying galvanism.

Mr. Farlandier resorted to galvanism to aid the action of the needles, by applying the negative pole only to the needles.

It has been suggested by Sir. W. Philip, and practised by others with success, to apply the galvanism by two plates, the one of copper, and the other of zinc, worn with the ordinary dress.

Even the electricity, generated by wearing a silk and flannel garment together, might be useful in such cases.

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Another class of diseases, as spasmodic and local inflammatory, is, no doubt, produced or kept up by a superfluous quantity of electricity in the affected part. How this irregular distribution of animal electricity takes place, we pretend not to say; but we must admit the fact, that relief is, in many cases, afforded by acupuncture, which acts by taking of superfluous electricity.

The extent, to which the useful practical application of electricity to disease may be carried, is yet to be learned, though many cases of its utility, are recorded in the modern periodical journals. It should be remembered, that the most important facts, on which this theory is founded, are of but recent discovery, and that time has not

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not been afforded, for the general diffusion,
or practical application of this knowledge,
and I have no doubt, that the time
will soon arrive, when the electrical
machine, and galvanic trough, from
which we now derive but little benefit,
will be one of our most powerful remediable
agents, and that many diseases, now incurable,
will by their judicious application, be
placed entirely under the controul of
our art.

In the Spring of 1822 and Autumn of 1823

by Hugh Bennett Esq

of the State

1824

[Faint, mostly illegible handwriting in cursive script, likely bleed-through from the reverse side of the page.]

to the Chair

Western

In the Spring

By